

Chapter 12-7A-3
URBAN WILDLAND INTERFACE BUILDING TEST STANDARDS

UNLOADED DECK, DIRECT FLAME EXPOSURE
STANDARD 12-7A-3

STATE FIRE MARSHAL

Unloaded Deck, Direct Flame Exposure

Sec. 12-7A-300

- (a) **Application.** The minimum design, construction and performance standards set forth herein for unloaded decks are those deemed necessary to establish conformance to the provisions of these regulations.
- (b) **Scope.** This test method determines the performance of decks (or other horizontal appendages to structures) when exposed to direct flames. The under-deck flame exposure test is intended to determine the rate of heat release (RHR) and degradation modes of deck boards when exposed to a burner flame simulating a burning plant or debris beneath a deck.
- (c) **Tested and Listed Materials.** Materials and assemblies which have been tested and listed by an approved testing agency for the intended purpose need not be individually re-tested. Such individually tested and listed materials and assemblies shall be subjected to the performance standard tests to determine their suitability for use in the deck assembly.
- (d) **Alternate Constructions.** This standard does not expressly require the use of specific materials or forms of construction. Combinations of materials and assemblies may be investigated and tested in accordance with these regulations, and if found to be substantially equivalent in performance may be given recognition for approval.
- (e) **Referenced documents.**
1. ASTM D 4933 Guide for moisture conditioning of wood and wood-based materials
 2. ASTM E 603 Standard Guide for Room Fire Experiments
 3. ASTM E108 Standard Test Methods for Fire Tests of Roof Coverings
 4. UBC 8-2 (1994) Standard test method for evaluating room fire growth contribution of textile wall coverings
- (f) **Definitions.**
1. **Deck boards.** Horizontal members that constitute the exposed walking surface of the deck.
 2. **Rate of heat release.** The net rate of energy release as measured by oxygen depletion calorimetry.
- (g) **Test Apparatus** (see Figure 1)
1. **Deck support assembly.** Assembly that holds the test deck over the burner.
 2. **Baffle panels and joist support.** Horizontal metal plates to support the deck joists along their full length, and also to confine burner flames to the underside of the deck boards located between the support joists.
 3. **Back wall.** Ceramic fiber board or another noncombustible panel product for the back wall material. Total height of the back wall is 8 ft. (2.4 m.).
 4. **Ledger board.** A 4-ft. (1.2-m.) long simulated 2 x 6 in. ledger board will be constructed of layers of ceramic fiber board (or other noncombustible panel product) and attached to the wall at a height slightly below the overhang of the rear deck board of the test deck.
 5. **Burner location.** The burner position is centered directly below the third (center) deck board from the front of the deck, midway between the joists.
 6. **Burner to deck distance.** The distance from the top of the burner to the underside of the deck boards shall be 27 in. (690 mm).

7. **Burner.** A 12 x 12 in. (300 x 300 mm.) sand burner shall be used to provide an output of 80 +/- 4 kW using a regulated propane gas source (see Figure 2). Note: Burner output can be calculated from propane flow rate, temperature, and pressure.
 8. **Oxygen depletion calorimeter.** The system includes a hood, associated ducting, and instrumentation to provide RHR data by oxygen depletion calorimetry.
- (h) **Materials.**
1. All deck board materials are to have the cross-sectional dimension equivalent to use in service.
 2. Commercially available products are to be obtained from a wholesale or retail supplier, not directly from the manufacturer.
 3. The deck board material, if not solid wood, may be analyzed for material composition.
 4. If solid wood deck boards are used, the species is to be determined.
 5. If the material is "plastic lumber" or other composite, such characteristics shall include the type and amounts of the plastic(s) and the wood-plastic ratio.
 6. All materials are to be conditioned to equilibrium to 6% EMC conditions prior to testing as specified in ASTM D4933.
- (i) **Test Assembly.**
1. **Size.** The overall size of the test deck shall be 2 x 2 ft. (610 x 610 mm.) unless width variation of deck boards requires an increase in overall deck width (i.e., the direction of joists) in order to meet the overall dimensions. The length of individual deck boards shall be 2 ft (610 mm).
 2. **Joists.** The deck is supported by two sets of 2 x 6 in. Douglas fir joists, 28.1 in. (712 mm.) long, and constructed with a 16-in. (406 mm.) center-to-center spacing. The joists shall be conditioned to 6% EMC. Note: A comparable species that may be more commonly used for structural framing of decks in a given region can be substituted for Douglas-fir.
 3. **Deck board spacing and fastening.** Edge-to-edge spacing is 3/16 in. (5 mm.), with boards attached to the joists with 2-in. (50 mm) deck screws inserted into deck boards spaced 1.5 in. (38 mm.) from the front and back edges of the deck boards. The front deck board shall be flush with the ends of the joists, and the rear deck board shall overhang the end of the joists by 1 in. (25 mm.).
 - i) Note: Boards manufactured for tongue and groove edge connections are to be spaced as per the manufacturer's recommendation.
 - ii) Note: Alternate fastening schedules can be used if specified by the deck board manufacturer.
 - iii) Note: If nominal 2 x 6 in. deck boards are used, a total of 5 boards shall be used for each deck. Changing the board width could change the number of deck boards in the deck.
- (j) **Conduct of Tests.** The under-deck flame exposure test measures the performance of the decking material when the underside of the deck is directly exposed to an 80 kW burner output for 3 min. (the same test shall be used for all types of decking materials).
1. **Burner output verification.** Without a deck in the apparatus, set the output of the burner to 80 kW (\pm 4kW). Conduct a verification run of 3 min. to assure the heat release rate, then turn off the burner.
 2. **Measurement of rate of heat release.** RHR is measured during the unloaded tests with a properly calibrated oxygen depletion calorimeter.
Procedures. With the deck in position, the burner shall be ignited to provide a constant 80 kW output for 3 minutes, at which time the burner shall be turned off. The deck materials and assembly shall be observed for sustained combustion for the duration of 40 minutes.
 3. **Observations.** The physical changes of the deck boards shall be noted during the test, including deformation from the horizontal plane, location of flaming and glowing ignition, cracks or checks, and loss of material (i.e, flaming drops of particles falling from the deck). Note: It is desirable to capture the entire test with a video recorder to allow review the details of performance.
 4. **Termination.** The test shall be terminated immediately if 1) flaming or glowing combustion of the deck boards stops, if 2) flaming combustion accelerates rapidly (runaway combustion), if 3) a board collapses or if 4) 40 min elapses.
 5. **Report** the following information: a description of the deck board material, the time of any observation of degradation (accelerated combustion, board collapse, flaming drops or particles

falling from the deck), peak net heat release, and net heat release rate during the course of the test, and any other observations during the test.

(k) **Conditions of Acceptance.**

1. **Duration of direct flame exposure.** To pass this test standard, the deck materials and assembly shall withstand 3 minutes of direct flame exposure with the absence of sustained combustion of any kind.
2. **Sustained Combustion** of any kind noted within the 40 minute observation period shall constitute failure of this test standard.

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